Forest Research Notes

Northeastern Forest Experiment Station

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DEVELOPMENT OF YELLOW BIRCH NURSERY STOCK NOT AFFECTED BY TRANSPLANTING

In nursery seedbeds, severe root competition soon develops among seedlings of yellow birch *(Betula alleghaniensis)*. This is due to the characteristic root system of the species--wide-spreading lateral growth with little downward penetration (fig. 1).

For comparison, look at the root systems of sugar maple *(Acer saccharum)* and white ash *(Fraxinus americana)*. They reach deeper and have a marked distinction between central taproot and laterals (fig. 2).

In densely stocked yellow birch seedbeds, transplanting or thinning appears to be desirable by the end of the first year. Though thinning is less expensive than transplanting, it does cause waste of many seedlings--and this is important if the stock is valuable (for example, in genetics research or when seed supply is limited). Growing interest in hardwood planting and the paucity of information about handling seedlings both in the nursery and in the field indicated a need for research on the responses of important northern hardwood species to transplanting.

So, to determine the effects of transplanting, size of stock, and root-pruning on early survival and growth of 1-0 yellow birch seedlings, a small transplanting study was made at the Burlington, Vermont, unit of the Northeastern Forest Experiment Station's Laconia Research Center.

STUDY OF TRANSPLANTING

The soil in the transplant bed was a moderately well-drained loam. The area was fertilized with 0-15-30 (NPK) at 200 pounds per acre, primarily to correct a potassium deficiency.

Four transplanting treatment combinations were compared: two seedling sizes, each root-pruned and not pruned,

Figure 1.--*Yellow birch seedlings send their roots out rather than down, resulting in early root competition. Note root system on this 1-0 seedling.*

Figure 2.--*Sugar maple and white ash seedlings tend to develop taproots. The 1-0 maple (left) has a strongly defined taproot. On the month-old ash (right) the taproot and the laterals already are clearly differentiated.*

plus a control consisting of undisturbed seedlings thinned in the seedbed to allow each one at least 30 square inches of space. The larger seedling size averaged 2.5 (range 2.0 to 3.0) inches, the smaller 1.5 (range 1.3 to 1.7) inches. In the root-pruning treatments, laterals were trimmed to 2.0 inches on seedlings of the larger class, and to 1.5 inches on those of the smaller class.

Transplanting and thinning were done during late April, shortly after the seedlings had broken dormancy. The transplants were lined out as bare-rooted stock soon after lifting. Spacing was 10 inches between rows and 5 inches between plants within each row. Transplants and seedlings were lightly mulched with pine needles and were weeded frequently during the growing sesson.

A randomized block design was used with three replications and 90 seedlings per treatment. Final measurements were taken after one growing season: (1) survival and field height[1] of all plants, and (2) stem length, oven-dry weight of stem and roots, and stem diameter at root collar for 18 sample plants from each treatment.

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[1]Only 12 undamaged seedlings were available from the control because of deer browsing 2 weeks before the study ended.

RESULTS AND RECOMMENDATIONS

Survivals ranged from 94 to 99 percent, and mean field heights from 14.2 to 17.2 inches. None of the differences was significant at the 5-percent level.

Nearly all plants had multiple stems, apparently caused by dieback of the terminal shortly after the transplanting or thinning. Since both thinned seedlings and transplants were afflicted, the dieback cannot be attributed to transplanting shock.

Root systems of both seedlings and transplants still exhibited the wide-spreading characteristics typical of 1-year seedlings (fig. 3). Root-pruning and transplanting had not resulted in any notable improvement in form or structure of the root systems.

Characteristics measured on the 18-tree samples are summarized in table 1. None of the measured characteristics differed significantly among treatments and seedling sizes at the 5-percent level. However, trends are evident in the stem-length and dry-weight averages that come close to statistical significance. The 2.5-inch seedlings consistently averaged longer stems and greater weight than the 1.5 inch

Table 1.--Treatment means for various measurements, based on 18-tree samples

Item	Treatment	Seedling size		Mean
		1.5 inches	2.5 inches	
Stem length[1]		Feet	Feet	Feet
	Pruned	1.12	1.34	1.23
	Not pruned	1.30	1.47	1.38
	Mean	1.21	1.40	1.31
Stem diameter at root collar[2]		Inches	Inches	
	Pruned	7/32	9/32	--
	Not pruned	9/32	9/32	--
Oven-dry stem weight[1]		Grams	Grams	Grams
	Pruned	1.33	2.22	1.78
	Not pruned	2.16	2.68	2.42
	Mean	1.74	2.45	2.10
Oven-dry root weight[3]		Grams	Grams	Grams
	Pruned	1.60	2.65	2.12
	Not pruned	2.36	2.84	2.60
	Mean	1.98	2.74	2.36
Root shoot ratio[1]				
	Pruned	1.20	1.19	--
	Not pruned	1.09	1.06	--

[1]Comparable data not obtained for thinned seedlings because of deer damage.
[2]Thinned seedlings in seedbed averaged 9/32 inch stem diameter.
[3]Thinned seedlings in seedbed averaged 2.63 grams oven-dry weight.

Figure 3.--*The treatment produced no change in the form or structure of the root systems of yellow birch. The 2-0 seedling at left and the 1-1 transplant at right both have the characteristic wide-spreading root systems.*

plants; and, within size classes, seedlings that were not root-pruned averaged longer and heavier than root-pruned ones. These differences are in the direction that might logically be expected. It seems possible that, with larger samples, the differences would have attained statistical significance.

However, regardless of statistical significance, the observed mean differences are relatively small and probably are of little importance in terms of quality of stock for field planting.

Since this experiment was conducted in only one place, on a loam soil, and during a season of abundant and well-distributed rainfall, somewhat different results might possibly be obtained under other conditions. However, the present results suggest the following general guides for handling 1-year-old yellow birch in dense seedbeds:

- If the stock is of sufficient value to justify the cost, transplant seedlings of all sizes (except obvious weaklings and defectives).

- Do not root-prune other than incidental trimming of long roots for convenience in handling.

- If stock values do not justify transplanting costs, thin the seedlings in the bed, favoring the larger ones insofar as their distribution permits.

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